

Here's why whales don't drown when they gulp down food underwater

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Ever wondered whether whales can burp, and why they don't drown when they gulp down gallons of water and krill? New UBC research may just hold the answer.

Researchers found that lunge-feeding [whales](#) have an 'oral plug', a fleshy bulb in their mouths that moves backwards to seal off the upper airways during feeding, while their larynx closes to block the lower airways.

This plug prevents water from entering their lungs when they feed, according to a paper published today in *Current Biology*. "It's kind of like when a human's uvula moves backwards to block our nasal passages, and our windpipe closes up while swallowing food," says lead author Dr. Kelsey Gil, a postdoctoral researcher in the department of zoology.

Lunge-feeding whales eat by, you guessed it, lunging at their prey, accelerating at high speed and opening their mouths to engulf water and krill. Sometimes this amount can be larger than their own bodies, says Dr. Gil, an impressive feat given this group includes the humpback and the [blue whale](#), the largest animal on Earth. Water is then drained via their baleen, leaving the tiny, tasty krill behind to be swallowed.

The researchers investigated [fin whales](#) specifically, a type of lunge-feeding whale and found the 'oral plug' needed to move in order to allow food to pass to the esophagus. The only way it could was towards the back of the head, and up, blocking off the nasal passages when the whale swallows. Simultaneously, cartilage closes at the entrance to the larynx, and the laryngeal sac moves upwards to block off the lower airways, says Dr. Gil. "We haven't seen this protective mechanism in any other animals, or in the literature. A lot of our knowledge about whales and dolphins comes from toothed whales, which have completely separated respiratory tracts, so similar assumptions have been made about lunge-feeding whales."

It turns out humans have a similar system to swallow food without getting anything in their lungs: we have the epiglottis and soft palate, a 'lid' of cartilage and a flap of muscle in our throat and mouth, respectively. Humans could probably eat underwater as well, says Dr.

Gil, but it would be rather like swimming at high speed towards a hamburger and opening your mouth wide as you approached—difficult not to flood your lungs.

The whales' oral plug and closing larynx is central to how lunge-feeding evolved, a key component in the enormous size of these creatures, the researchers say. "Bulk filter-feeding on krill swarms is highly efficient and the only way to provide the massive amount of energy needed to support such large body size. This would not be possible without the special anatomical features we have described," says senior author Dr. Robert Shadwick, a professor in the UBC department of zoology.

Investigating whale anatomy often involves trying to dissect whales that have died from stranding which comes with such challenges as trying to complete work before the tide rises. However, for this research, Dr. Gil and her colleagues dissected whales in Iceland in 2018, recovering tissue that wasn't being used for food from a commercial whaling station. Working with whales in real-time would be wonderful, she says, but might require some advancements in technology. "It would be interesting to throw a tiny camera down a whale's mouth while it was feeding to see what's happening, but we'd need to make sure it was safe to eat and biodegradable."

The team will continue to explore the mechanisms related to the pharynx, and of the small esophagus that is responsible for rapidly transporting hundreds of kilograms of krill to the stomach in less than a minute. With the many human impacts that disrupt food chains, and knowing how whales feed and how much they eat, it's good to know as much as possible about these animals in order to protect them and their eco systems, says Dr. Gil.

And there's plenty more to find out, including whether whales cough, hiccup, and yes, burp. "Humpback whales blow bubbles out of their

mouth, but we aren't exactly sure where the air is from—it might make more sense, and be safer, for whales to burp out of their blowholes."

More information: Kelsey N. Gil, Anatomical mechanism for protecting the airway in the largest animals on earth, *Current Biology* (2022). DOI: [10.1016/j.cub.2021.12.040](https://doi.org/10.1016/j.cub.2021.12.040). [www.cell.com/current-biology/f... 0960-9822\(21\)01727-9](https://www.cell.com/current-biology/fulltext/S0960-9822(21)01727-9)

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